ing report on the subject, by Messrs. R. G. McConnell and R. W. Brock, has since been issued by the Geological Survey of Canada (part viii., Ann. Rep. for 1903). The conclusions arrived at fully confirm the explanations previously given by Mr. Brewer, but the authors add that recent earthquake tremors no doubt hastened the time of the final disruption. They regard the present state of Turtle Mountain as dangerous, and recommend the removal of the town of Frank to a site higher up the valley of the Old Man River. The report is illustrated by map, sections, and numerous pictorial views.

THE Geological Survey of India has revived the publication of its *Records*, a serial which was established in 1868, and amalgamated with the *Memoirs* in 1897. In justification of this step, the director, Mr. T. H. Holland, points out that during the course of the survey work many observations are made from time to time that it would be advisable to publish as promptly as possible, on account of their bearing on current scientific problems or of their economic value. The present number (vol. xxxi., part i.) contains accounts of coal-deposits, copper ore, sapphirine-bearing rock, together with miscellaneous notes on tin-ore, gem sands, &c., and selections from assays made in the laboratory relating to coal and manganese-ores. Mr. Holland expresses the hope that contributions will be made by private workers, to whom the *Records* will be open for original observations on geological subjects.

IN the April *Bulletin* of the Johns Hopkins Hospital (xv., No. 157), Dr. George Dock discusses vaccine lymph and vaccination especially as regards American practice. Dr. Watts Lee publishes studies of the sinus frontalis of man and of certain mammals, carried out both by dissections and by means of lead casts, and Dr. Hastings describes a new blood stain possessing advantages over the Romanowsky and Leishmann stains, which should prove very useful, as it is permanent in the preparations, and the solution keeps well.

IN NATURE of March 17 (vol. lxix. p. 467) a review was given of the anti-malarial operations at Mian-Mir. A second report on the subject has now been published, and gives additional details (*Sc. Mem. of the Gov. of India*, No. 9, by Lieut. S. R. Christophers, I.M.S.). The conclusions are in accordance with those expressed by Captain James, I.M.S., in the first report. It is found that the destruction of the anopheles mosquito within an area by attacking their breeding places is extremely difficult, the mere obliteration of local breeding places being useless. Thus at Mian-Mir, although large numbers of pools were filled up and drained, and almost complete absence of breeding was ensured to a distance of half a mile, adult anopheles still appeared in large and increasing numbers, apparently due to immigration from without. Although a distinct effect was produced on the incidence of malaria among the troops and on the endemic index of the native bazaars, it was only evident at the beginning of the fever season, and could not be maintained. The value of quinine administration was found to depend on the efficiency of the supervision exercised; when quinine was regularly taken the admission rate for fever was much reduced. The conclusion is formed that although some effect on malaria was produced by anti-mosquito measures, these are not those best adapted at Mian-Mir to the eventual reduction of malaria.

THE third issue of *The Central*—the journal of the Central Technical College Old Students' Association—is an excellent number. Prof. Armstrong, F.R.S., contributes the first of a series of short articles on the mechanism of combustion. Among other articles we notice two which are illustrated—one on popular motor cars, by Mr. M. O'Gorman, and the other by Mr. R. W. Sindall, on the manufacture of wood-pulp.

A SECOND edition, revised and enlarged, of the "Student's Handbook of British Mosses," by Mr. H. N. Dixon, the first edition of which was reviewed at length in our issue of September 10, 1896 (vol. liv. p. 434), with illustrations and keys to the genera and species by Mr. H. G. Jameson, has been published by Mr. V. T. Sumfield, Station Street, Eastbourne. Since the publication of the first edition of the book, some thirty species or subspecies of British mosses have been detected, together with a corresponding number of varieties. These additions have been interpolated in the second edition, and notes also have been provided where recent knowledge necessitated their inclusion. Some slight alterations, too, have been made in the general arrangement of the book.

OUR ASTRONOMICAL COLUMN.

THE NUMBER OF THE STARS.—In No. 114 of *Popular Astronomy*, Mr. Gavin J. Burns makes some calculations and deductions as to the number of stars in the entire sky from the various star catalogues and photometric durchmusterungs which have been published. On the assumption that, on the whole, the stars are evenly distributed, he deduces from the plates taken for the Greenwich zone of the Astrographic Chart that there are 38 stars brighter than the second magnitude, 13,421 brighter than the seventh, and 8,325,000 brighter than the fifteenth. The ratio of the total number of stars brighter than any one magnitude to the number brighter than the next magnitude fainter is fairly constant at about 3·4 until the tenth magnitude is reached, but beyond that there is a sudden drop to 1·9, which ratio continues down to magnitude 15. From this discussion there is strong presumptive evidence that the stars thin out as their distance from our system increases.

RADIAL VELOCITIES OF THE PLEIADES.—From an investigation of a series of plates taken with the Bruce spectrograph, using only *one* prism, Mr. W. S. Adams, of the Yerkes Observatory, has determined the radial velocities of the Pleiades stars as follows:—

Name.	Bessel's number.	Mag.	Mean vel. in km.
Electra ...	17 Tauri ...	3·8 ...	+15
Taygeta ...	19 ,, ...	4·4 ...	+ 3
Merope ...	23 ,, ...	4 2 ...	+ 6
Alcyone ...	25 ,, ..	3·0 ...	+15
Atlas ...	27 ,, ...	3·8 ...	+13

Measurements of seven spectrograms of Maia (20 Tauri) indicate that this star has a variable velocity ranging from −7·4 km. (October 30, 1903) to +20·9 km. (December 25, 1903). The lines in the spectrum are well defined, so that although the range of variability is not very large, it is almost certainly real.

The spectra of Maia and Taygeta are at variance with what we should expect to find for stars associated with a nebula, and they engender a suspicion that these stars may not be physically connected with the surrounding nebula (*Astrophysical Journal*, No. 5, vol. xix.).

AN EXPEDITION FOR SOLAR RESEARCH.—With the aid of a grant of 10,000 dollars from the Carnegie Institution, the Yerkes Observatory has sent an expedition to Mount Wilson (altitude 5886 feet), near Pasadena, California, for the purpose of making special investigations of the sun.

The Snow horizontal telescope is to be the principal instrument erected. One of the concave mirrors of the coelostat reflector, having a focal length of 145 feet, will give a solar image 16 inches in diameter, and will be used for special spectroscopic studies of sun-spots and other solar phenomena. A spectroheliograph of 7 inches aperture and 30 feet focal length is also to be used in connection with this mirror. A stellar spectrograph provided

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with a large concave grating is to be used to obtain, if possible, spectra of the brighter stars. The expedition is under the immediate direction of Prof. Hale.

THE ORBIT OF COMET 1889 IV.—The following elements for comet 1889 IV. have been calculated by Dr. Guido Horn, of Trieste, and are published in No. 5, vol. xxxiii., of the *Memorie della Societa degli Spettroscopisti Italiani*:—

$T = 1889$ July 19·32298 (M.T. Berlin)
$\omega = 345^\circ\ 52'\ 42''\cdot83$
$\Omega = 286^\circ\ 9'\ 18''\cdot31$
$i = 65^\circ\ 59'\ 11''\cdot17$
$\log q = 0\cdot0169197$
$\log e = 9\cdot9990087$
$\log a = 2\cdot6590039$
Period = 9738·81 years.

A table showing the similarity of the orbit of this comet to those of six others which have appeared since 1684 is also given.

NEW LISTS OF VARIABLE STARS.—*Circular* No. 79 of the Harvard College Observatory contains a list of 19 new variable stars situated in the constellations Orion and Carina, and a list of 57 new variables in the region of the small Magellanic Cloud. A careful examination of 1167 star images, contained in a region 30′ square, on two plates of the Trifid nebula revealed no variables.

Circular No. 80 gives the positions and spectral characters of six new variables discovered by Mrs. Fleming on the Draper memorial photographs.

Circular No. 81 is devoted to some notes on eight variable stars of long periods prepared by Miss Cannon from her observations with the 6-inch telescope. The notes contain short comments upon the individual observations and on the agreement of the observed magnitudes on different dates with the various published elements for each star.

THE EDUCATION OF THE AMERICAN ENGINEER.

THE growing success of American and German manufacturers in the international competition for the world's markets has in recent years commanded alike the earnest attention of our industrial leaders and of our educational authorities. As numerous articles in these columns have testified, many serious attempts have been made during the past few years by expert observers from this country to try to discover the precise connection between foreign industrial success and the educational systems of the countries the competition of which has been brought home to us most decidedly; and the greatest attention has perhaps been given to the manner in which foreign engineers are prepared in schools and colleges for their life's work. It is little more than a year ago that Prof. W. E. Dalby laid before the Institution of Naval Architects and the Institution of Mechanical Engineers the results of his commission from Mr. Yarrow to report on the training of engineers in other countries, and as recently as May 5 the report of the Mosely Educational Commission, which dealt at some length with the same subject, was reviewed in NATURE. The most recent contribution to this important subject is a paper by Dr. Mullineux Walmsley read before the Institution of Electrical Engineers, and published in the *Journal* of that society for May. Dr. Walmsley was given leave of absence by the governing body of the Northampton Institute, of which he is principal, and was instructed to investigate the methods of higher engineering education in the United States and Canada, and more particularly the effect, so far as it could be ascertained, of the education on the engineering industries, the views of the great manufacturers and employers on the value of the products turned out by the schools, and the attitude generally taken up by them towards these schools. The paper embodying the chief conclusions at which Dr. Walmsley arrived and the more important of his observations runs to fifty pages, and a few typical examples only can be given in the space available.

The paper is divided into six sections, the first five of which are concerned with higher mechanical and electrical engineering education to the practical exclusion of other branches of engineering instruction. It was originally intended to include a chapter on the training of bench hands, fitters and erectors, but eventually Dr. Walmsley contented himself with the statement that in many respects "our arrangements here for the training of bench hands, &c., are better than the corresponding facilities provided in the United States and Canada."

The engineering schools and their resources are first described. The number and extent of the buildings devoted to higher engineering education exceeds, says the paper, anything that we can show in this country, but more often than otherwise Dr. Walmsley found that the supply of buildings was proving inadequate. There is evidence throughout these American schools of lavish expenditure on equipment on a scale to which we are, as yet, quite unaccustomed. The laboratories and workshops are packed full of apparatus and machinery for the use of students. The author states, "it is difficult within the limits of a paper not dealing exclusively with equipment to convey an adequate idea of its complexity or extent to those who have not visited the actual laboratories." The special needs of teachers and students engaged in research work receive particular attention by those who are responsible for the equipment of engineering workshops and laboratories, and the apparatus and fittings available include delicate instruments unlikely to be required by the ordinary student, but available for special investigations. It is interesting in this connection to quote an expression of opinion by Prof. Armstrong in the discussion on the paper:—"There may be a good deal of provision made for research, but there is not much evidence of research work being done. What the colleges are suffering from very largely is great over-provision of appliances and under-provision of teachers and well-prepared students."

Dr. Walmsley's remarks on the staffs of American engineering institutions agree with expressions of opinion to be found in the reports of Profs. Ayrton, Maclean, and Ripper in the volume dealing with the Mosely Educational Commission. It may be said to be generally admitted in America that professors of engineering must be practical men possessing a modern working acquaintance with engineering processes on a commercial scale rather than men possessed of high academic qualifications. It is recognised by Transatlantic authorities, too, that it is all to the advantage of the students if the professor is also actively engaged in engineering practice, either as an advising expert or in some other capacity.

Financial considerations are given great prominence in the paper, and much the same ground is covered as that traversed by an article in NATURE of May 14, 1903, on "The University and the Modern State," though Dr. Walmsley, in addition, makes an interesting attempt to separate the expenditure on engineering from that on higher education as a whole. Many of the conclusions arrived at by Sir Norman Lockyer in his Southport address to the British Association are quoted and substantiated by the author's own observations.

A comparison is instituted between the mental stock-in-trade with which American and English young men respectively start their engineering training, and though Dr. Walmsley does not claim that the school training provided in the United States is perfect, he has little doubt of the greater suitability of the American training for boys intending to become engineers: "both because of the later age of entrance, and also because their general education, as a rule, has been carried to a higher point, it follows that the candidate for entrance into the technical courses in America is better equipped than those in this country to take advantage of the training of the professional school." Here, again, we find Prof. Armstrong dissenting; he is inclined to doubt altogether whether the average product which enters the colleges in America is in the least degree superior to the average product coming up to our colleges.

Under the heading "The Work of the Schools," much valuable material as to the characteristics of the engineering courses in the colleges of the United States is brought together. The rule is that in the first two years of the course—which generally lasts four years—a fair amount of time is given to mathematics, English, modern languages and experimental science, and it is chiefly in the workshop and drawing office that the specialisation towards engineering is apparent during these two years. Specialisation

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